

Cancer Incidence and Mortality in Eeyou Istchee

Public Health Department
Cree Board of Health and Social Services of James Bay



Conseil Cree de la santé et des services sociaux de la Baie James
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Cree Board of Health and Social Services of James Bay

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Foreword

Public health surveillance is a legal mandate of the Public Health Department. Activities related to this core function of the Public Health Department include the capacity to collect data, analyze it, and disseminate the information obtained to the general population and to other Cree health entities in order to support decision making, and programs/services planning and evaluation. The current report deals with the cancer situation in Eeyou Istchee.

Cancer is an important public health issue in Canada as in many other industrialized countries. It is also a human drama that affects not only men and women, but also their families and communities. This is a disease with so many faces it is nevertheless possible to prevent in a large proportion. Effective public health interventions and programs do exist. What is seriously lacking in our Aboriginal context is the information on the state and on the evolution of this health issue. The current report intends to address, at least partially, this problem. Its initial objective is to provide the general population, public health professionals and decision making bodies with the most detailed and available data on cancer incidence and mortality in Eeyou Istchee.

Having done this we see that cancer rates are globally lower in our region as compared to the Rest of Quebec. However, data on some aspects are critical and point to the cancer-related issues we should be looking after in coming years, mostly in the Eeyouch male population. Addressing cancer-related issues is by no means the responsibility of any single individual or entity. Rather, people from Eeyou Istchee and regional and local entities, whether they are from the health domain or not, are invited to partner in order to promote good health in our region.

Robert Carlin

Public Health Director

Executive Summary

Cancer is an important and well-documented public health issue in industrialized countries. However, cancer information on Canadian Aboriginals is scarce. Some studies have reported that for decades, Aboriginal communities have had lower cancer incidence/mortality rates, but more recent reports show that this has steadily increased. Based on incidence data (from 1985 to 2009) and mortality data (from 2000 to 2009), the current report compares the cancer profile of Eeyou Istchee (Health Region 18) to that of the Rest of Quebec (the province of Quebec without the Eeyou Istchee Health Region). Within Eeyou Istchee, analyses were limited due to the small numbers of cancer cases for each Cree community. Main conclusions were as follow:

- 1- The numbers of cancers in Eeyou Istchee (EI) have been increasing over the last 20 years because the size of the population has been increasing. However, the rates of cancer have been stable or are decreasing.
- 2- In comparison to other Quebec health regions, the rates of cancer in Eeyou Istchee are lower for all cancers except kidney cancer. This applied most often to males, as differences between females from Eeyou Istchee and elsewhere were generally not significant
- 3- Colorectal cancer is increasing and now matches Quebec's rate.
- 4- The ratio of mortality to incidence increased in males, from 2000-2004 to 2005-2009, indicating a decrease of the 5-year cancer relative survival rate in EI males.
- 5- Cree communities tend to have comparable rates of cancer incidence. However, Waskaganish had significantly lower rates compared to expected rates, while Whapmagoostui had significantly higher rates.

The report also suggests some priorities for cancer prevention in Eeyou Istchee. Indeed, available scientific knowledge shows that community programs at the population level and clinical preventive services at the individual level could contribute to lessen the burden of cancer by : a) addressing lifestyle factors like physical inactivity, obesity, smoking, heavy alcohol use, early age at first pregnancy; b) closely following patients and specially male cancer patients; and c) enforcing monitoring and health surveillance activities oriented towards selected risk factors, and health conditions and programs.

1- Introduction

Cancer is an important public health issue in industrialized countries. Indeed, many cancer registries have been developed in Canada, mostly at the provincial level. However, cancer information on Canadian Aboriginals is scarce. In fact, a 2003 review of chronic-disease coverage in Canadian aboriginal newspapers showed that of 400 chronic-disease articles, there were significantly more articles on HIV/AIDS (167 or 41.8%) and diabetes (135 or 33.8%) and fewer on cancer (56 or 14%) and cardiovascular disease (Hoffman-Goetz et al., 2003)

For decades, published studies on these populations have reported that Aboriginal communities tended to experience a lower incidence of cancer and related mortalities. However, many reports have pointed out that the situation has been steadily changing, with an increase in the incidence of cancer and related mortalities. Young et al. (2000) estimated rates of cervical cancer and Papanicolaou (Pap) testing among Aboriginal and non-Aboriginal women in Manitoba. They reported that Aboriginal women had 1.8 and 3.6 times the age-standardized incidence rates of *in situ* and invasive cervical cancer, respectively. With the exception of those aged 15 to 19 years, Aboriginal women were less likely to have had at least 1 Pap test in the preceding three years.

To date, the study of Young et al. remains one of the largest efforts to produce comprehensive, high-quality data on the burden of cancer in Ontario First Nations (FN), both currently and over time. It used a computerized record linkage of Ontario First Nations lists (1968-1991), cancer registry files (1968-2001), and all-cause mortality files (1968-2001). This study reported 2,365 new cancer cases in FN in 1992-2001. The top three cancers – breast/prostate (respectively for women and men), lung, and colorectal cancers – had similar incidence in both FN and Ontario. These three cancers accounted for more than 50% of all cancers in both men and women. Compared to the Ontario population as a whole, FN had a significantly lower incidence for: all cancers combined, breast, prostate, lung, colorectal in women only, and most other types of cancer. They had a similar incidence for kidney, mouth and throat, stomach, and colorectal cancer in men. However, FN had a higher incidence for gallbladder (significant only in women) and cervical cancer (not significant). Regarding the temporal trends of cancer, from 1968 to 2001, FN rates increased for all cancers combined, approaching current rates reported in Ontario for colorectal and lung. In the same period, rates of cervical cancer decreased to close to the Ontario rate. Survival analyses reported men had significantly worse survival rates for all cancers and for prostate cancer, while women had significantly worse survival rates for breast cancer, and slightly worse survival for other cancers.

Sheppard et al. (2010) compared the distribution of stages at breast cancer diagnosis between FN and non-FN women and reported that 66% of FN women were diagnosed at a later stage compared to 56% in non-FN women. Previously undiagnosed FN women who were overweight or obese were significantly more likely to be diagnosed at a later stage. Johnston et al. (2004) studied the community-based cultural predictors of Pap smear screening in Nova Scotia, and reported that Aboriginal women were less likely than women in mainland Nova Scotia to have had a recent Pap smear.

A 2008 study carried out by Louchini reported that from 1988 to 2004, there was no significant increase in cancer incidence or mortality in Quebec Aboriginal populations. Despite this, Aboriginal men tended

to show a higher incidence rate for some sites of cancer and a lower one for others. The authors concluded that the observed differences in specific sites suggested exposure to unique environmental risk factors. The same report stated that Quebec Cree people in general have a lower incidence of cancer and lower mortality rates than the rest of Quebec.

In concluding an internal brief report on cancer in Eeyou Istchee, Lejeune and Torrie (2010) discussed the need for a comprehensive report on cancer in the region. They also suggested that regional features be compared to other Aboriginal communities. The current report aims to integrate all available information to address some of these questions.

This report tabulates the **age-adjusted cumulative incidence/mortality rates** for all-cancer sites, with the related **standardized incidence/mortality rate ratios** to compare Eeyou Istchee with the Nunavik health region and the Rest of Québec, (i.e. the province of Québec except Eeyou Istchee). Incidence and mortality were adjusted by using the Quebec 2001 population as the standard population. We also compute the number of observed and expected cancer cases and standardized incidence ratios for 5 primary cancer sites (lung, breast, prostate, colorectal, and kidney) and for combined male and female cancers. The **observed cases** represent the total number of primary malignant tumors reported to the *Fichier des Tumeurs du Québec* (FITQ). The **expected cases** represent the total number of primary, malignant tumors that would have been diagnosed if Eeyou Istchee's male and female population had experienced the same age-specific rates of cancer incidence as those experienced by the general Quebec population. The **standardized incidence ratios**, or **SIRs**, that appear in this report were calculated by dividing the number of observed cases by the number of expected cases and multiplying the dividend by 100. Also shown in this report is whether a SIR represents a statistically significant higher or lower number of observed cancer cases (at the 95% confidence level). There are two series of SIRs: the first uses Quebec as a reference to test if there were greater or fewer numbers of cases in Eeyou Istchee. The second series of SIRs use Eeyou Istchee as the reference, and tested if the cancer burden in each Cree community was greater or lesser than expected within the region.

When reporting on cancer data, as with any other statistic on the Eeyouch, we often face the issue of small numbers of events. We used a statistical approach that is commonly accepted and used for small area analysis, and can also be easily understood by the general public. To have sufficient cases for robust statistics, summary data were analyzed in 5-year groupings. But this was still inadequate for some primary cancer sites. Therefore, for the sake of reliability, statistical analyses are not shown for any primary site with fewer than 10 cases reported during the given 5-year period.

2- Results

2.1 All cancer incidence and mortality

Observed cancer incidence data were available only for the period up to 2006 in the *Fichier des Tumeurs du Québec*. Data for the period 2007-2009 were therefore estimated (See Data Sources and Definitions in the Appendix section). Actual cancer related deaths were available up to 2009 in the *Fichier des Décès* of the Quebec Vital Statistics (*Registre des événements démographiques*).

2.1.1 All cancer incidence

According to our data, there were 395 observed primary cancer cases in Eeyou Istchee during the 1985-2006 period. As many males (n = 196) as females (n = 199) were diagnosed with cancer (Table 1a). Number of new cancer cases increases with age. However, cancer seems to be diagnosed in Eeyou Istchee at a younger age. Indeed proportions represented by younger age groups are higher in Eeyou Istchee as compared to the Rest of Quebec, but almost similar in Nunavik (Fig. 1). This translates into a mean age at diagnosis 5 years (95% CI: 3.1-6.8 years) lesser in Eeyou Istchee as compared to the Rest of Quebec. Nonetheless, this difference is of small effect and holds only for all female cancers (7 years; 95%CI for difference: 2.9-10.4) and marginally for female breast cancer (5 years; 95%CI: 0.2-9.1).

Figure 1: Distribution of actual incident cancer cases by 10-year age group, Eeyou Istchee and Rest of Quebec, 1985-2006

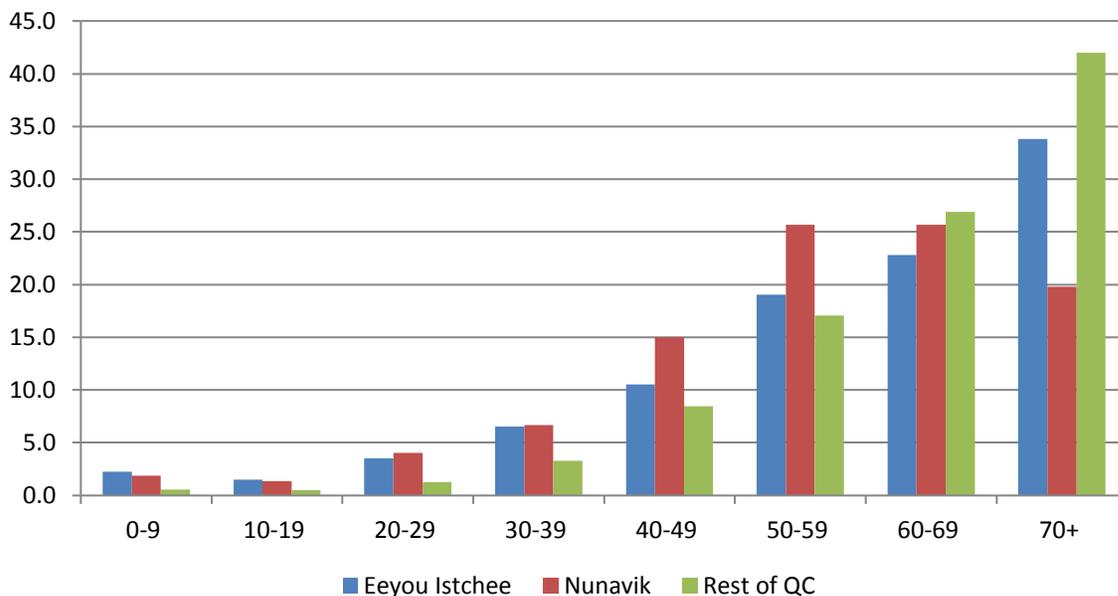


Table 1a: Actual number of new cancer cases by sex and age, Eeyou Istchee, 1985-2006

	1985-1989	1990-1994	1995-1999	2000-2004	2005-2006	Total 1985-2006
Total	72	70	95	108	50	395
Females	35	32	50	54	28	199
Males	37	38	45	54	22	196
Mean annual no. of cases	14	14	19	22	25	18
0-39 years	10	13	10	13	9	55
40-49 years	5	9	13	10	5	42
50-59 years	12	12	21	20	9	74
60-69 years	17	11	18	27	17	90
70 years +	28	25	33	38	10	134

Assuming current rates of cancer continue as they are, the following projections for 2007-2009 were calculated (Table 1b). The data shows that an additional 76 newly-diagnosed cases would be expected: 40 cases in females and 36 in males.

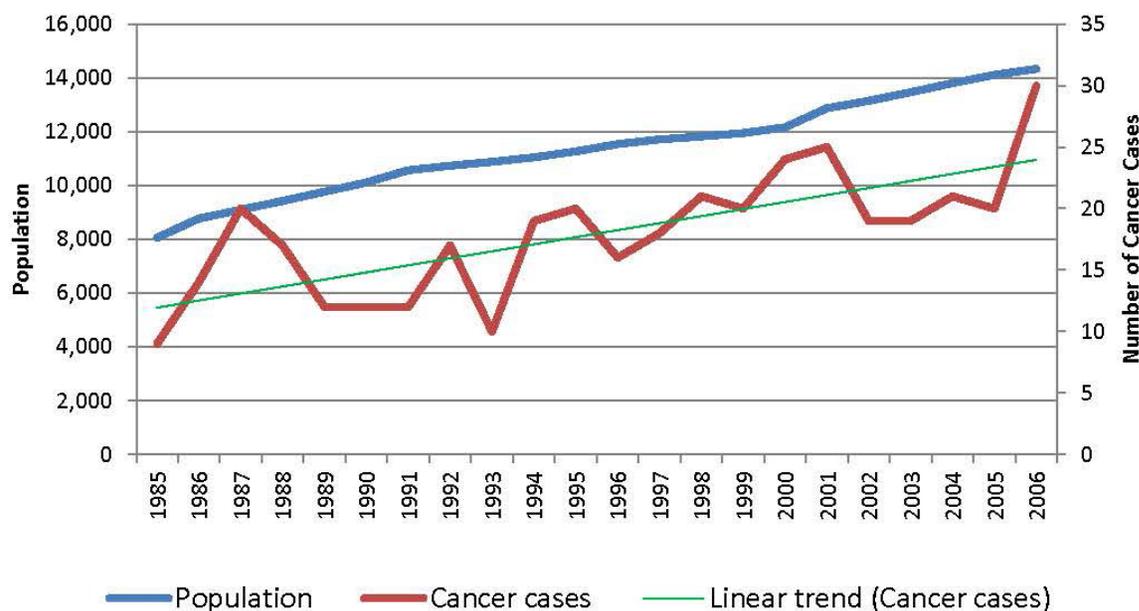
Table 1b: Actual and projected number of newly-diagnosed cancer cases by sex and age, Eeyou Istchee, 1985-1989 to 2005-2009*

	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009	Total 1985-2009
Total	72	70	95	108	126	471
Females	35	32	50	54	68	239
Males	37	38	45	54	58	232
Mean annual no. of cases	14	14	19	22	25	19
0-39 years	10	13	10	13	20	66
40-49 years	5	9	13	10	12	49
50-59 years	12	12	21	20	23	88
60-69 years	17	11	18	27	39	112
70 years +	28	25	33	38	32	156

* n for 2005-2009 is the sum of observed (2005 and 2006) and estimated number of cases for the period. N for 2007-2009 was estimated by multiplying the most recent 5-year (2002-2006) observed age and sex rates by the corresponding population numbers

The mean annual number of new cancer cases is increasing in the region (Table 1a and 1b). However, this is likely related to the increasing size of the Eeyou Istchee population (Fig. 1).

Figure 2: Eeyou Istchee population trends and cancer incidence, 1985-2006



Average annual crude incidence rates for the study period were: 159 for the total population, 164 for females, and 155 for males per 100,000, respectively. As one would expect, this crude rate increased with age, from 29 per 100,000 for those under 40, to 1,837 per 100,000 for those aged 70 and over (Table 1c).

Table 1c: Crude cancer incidence (per 100,000 people) by sex and age, Eeyou Istchee, 1985-1989 to 2005-2009*

	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009	Total 1985-2009
Total	160	131	163	165	172	159
Females	157	122	174	167	189	164
Males	162	141	152	163	156	155
0-39 years	27	30	22	26	37	29
40-49 years	-	-	253	151	143	174
50-59 years	516	475	616	466	447	497
60-69 years	1,167	688	963	1,140	1,268	1,084
70 years +	2,418	1,362	,2040	2,158	1,527	1,837

* Rates for 2005-2009 is based on both observed (2005 and 2006) and estimated (2007-2009) number of cases for the period

The top three malignant neoplasms were breast, kidney and colorectal cancers for females (Fig.2a), and lung, prostate and colorectal cancers for males (Fig. 2b). For both females and males, the top three accounted for 46% of newly-diagnosed cancer cases. In comparison, the top three cancers in women were breast (29%), colorectal (14%) and lung cancers (13%) for the Rest of Quebec. For males, the top three cancers were the same as in the Rest of Quebec.

Figure 2a: Cancer incidence in females, Eeyou Istchee, 1985-2006

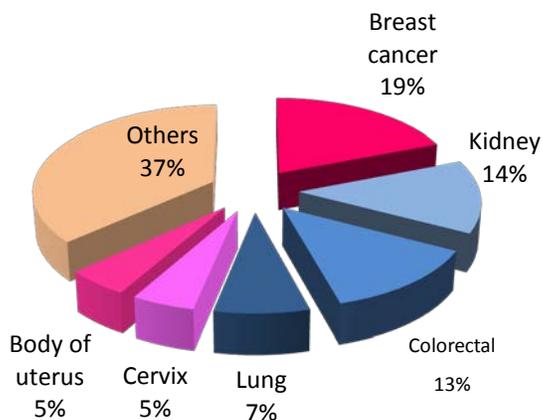
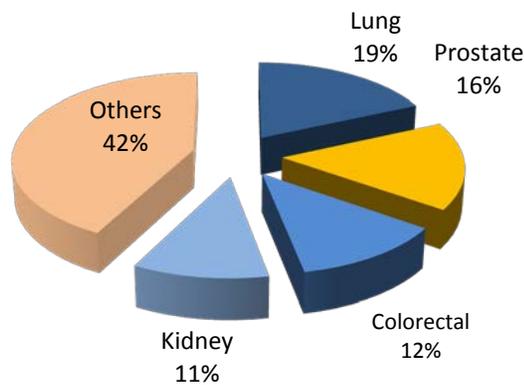
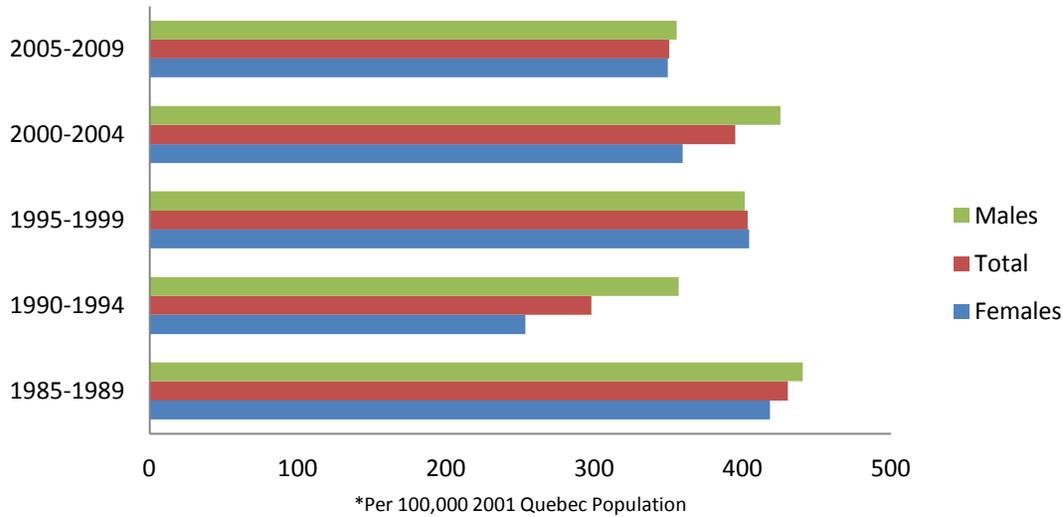


Figure 2b: Cancer incidence in males, Eeyou Istchee, 1985-2006



Annual age-adjusted incidence rates showed that cancer is slightly more common among males than among females, but these differences were not significant (Fig. 3).

Figure 3: Average annual age-adjusted incidence* by sex, Eeyou Istchee, 1985-1989 to 2005-2009



Over the study period, people in Eeyou Istchee experienced a lower incidence of cancer, whether it is compared to Nunavik or to the Rest of Quebec (Fig. 4). However, this difference was significant and consistently observed only for males when Eeyou Istchee is compared to the Rest of Quebec (Table 2). By contrast, the cumulative incidence of cancers in Eeyou Istchee females was less often significantly different from that of the Rest of Quebec.

Figure 4: Average annual age-adjusted incidence rates, Eeyou Istchee versus other health regions, 1985-1989 to 2005-2009

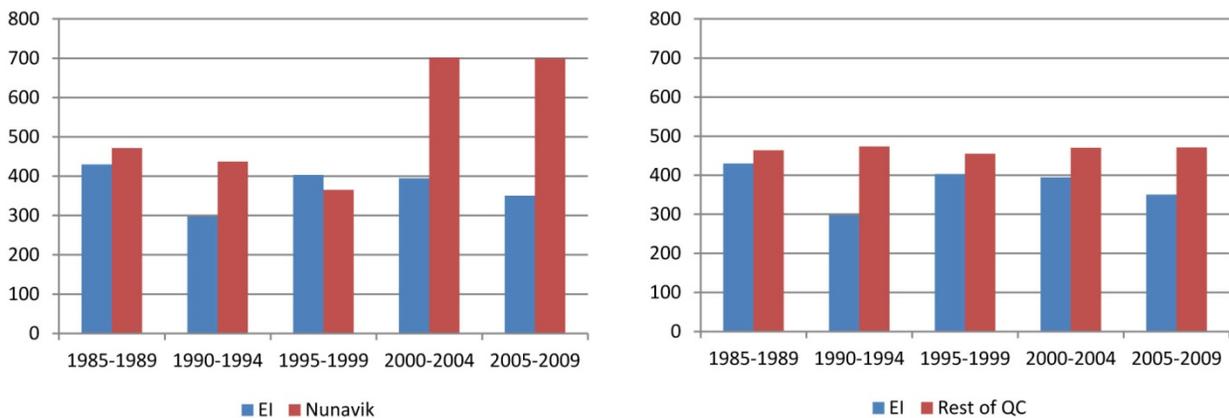


Table 2: All cancer incidence: age-adjusted rates (AAR), (per 100 000) and standardized rate ratios* (SRR) (%) by Sex and Health Region, 1985-1989 to 2005-2009

	<i>Health Region</i>	<i>Eeyou Istchee</i>		<i>Rest of Quebec</i>		SRR (%)
		n**	AAR	n	AAR	
1985-1989	<i>Females</i>	35	418	59,347	392	107
	<i>Males</i>	37	440	66,588	577	76
	<i>Total</i>	72	430	125,935	464	93
1990-1994	<i>Females</i>	32	254	68,045	399	<u>64</u>
	<i>Males</i>	38	357	77,430	589	<u>61</u>
	<i>Total</i>	70	298	145,475	473	<u>63</u>
1995-1999	<i>Females</i>	50	404	75,405	404	100
	<i>Males</i>	45	401	78,740	538	<u>75</u>
	<i>Total</i>	95	403	154,145	455	89
2000-2004	<i>Females</i>	54	360	86,861	422	85
	<i>Males</i>	54	425	90,804	546	<u>78</u>
	<i>Total</i>	108	395	177,665	470	<u>84</u>
2005-2009	<i>Females</i>	68	349	96,753	428	82
	<i>Males</i>	58	355	103,041	536	<u>66</u>
	<i>Total</i>	126	350	199,794	471	<u>74</u>

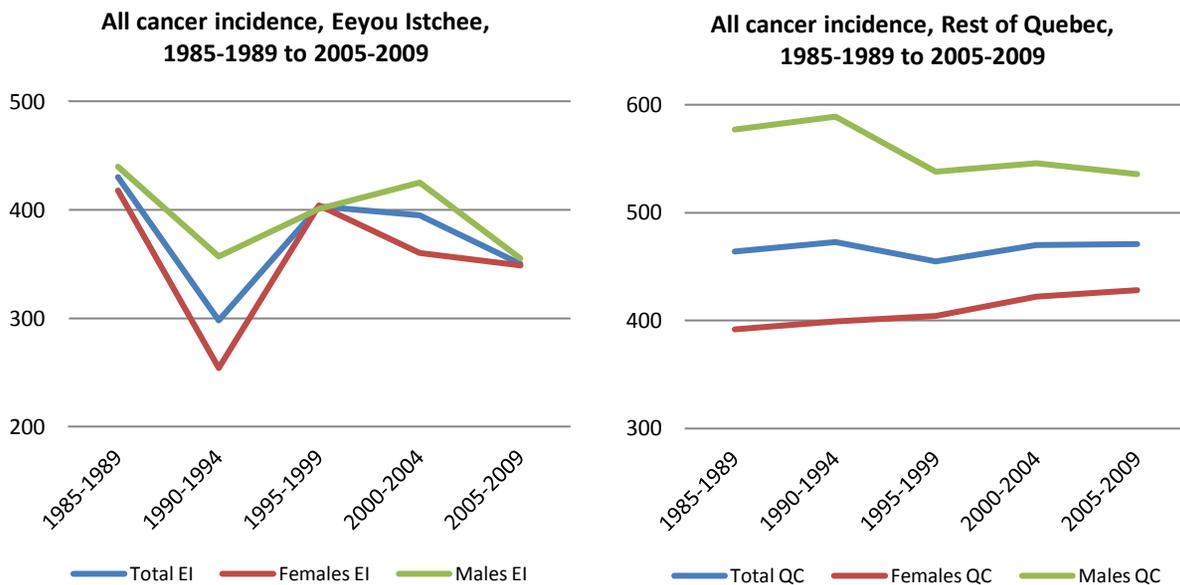
* Standardized rate ratio (SRR) is obtained by dividing the (directly) standardized rate for Eeyou Istchee by that of the Rest of Quebec. Eeyou Istchee is said to have a lower incidence rate if the SRR is less than 100, or the opposite if the SRR is higher than 100. Significant differences at 95% CI are underlined.

**n = number of incident cancer cases

2.1.2 All cancer incidence over time in Eeyou Istchee

Trends in age-adjusted cumulative incidence are shown in Figure 5. In Eeyou Istchee, despite the up-and-down picture data revealed, it is fair to state that the risk of contracting cancer in general was stable over time. However, males had experienced a small decrease during the study period. These trends were comparable to that of the Rest of Quebec, where the small increase in female risk was compensated by a small decrease in male risk.

Figure 5: Trends in the incidence of all cancer (per 100,000), by sex, Eeyou Istchee, and the Rest of Quebec



2.1.3 All cancer mortality in Eeyou Istchee

In Quebec, and therefore in Eeyou Istchee, mortality data were coded with the ICD-9-CA before 2000 and with the ICD-10-CA from 2000 on. It was suggested to avoid any specific cause analysis of death data not coded with the same version of the ICD (Geran et al., 2005). So, we limited our analyses to deaths that occurred from 2000 to 2009. For that time period, there were 100 deaths related to malignant neoplasms in Eeyou Istchee, with 56 of those occurring in males.

Overall, Eeyou Istchee had a significantly lower cancer mortality rate compared to the Rest of Quebec. However, there were some variations within this overall rate, as Table 3 below shows. Indeed, for the study period, the mortality rates of Eeyou Istchee females were somewhat comparable to that of women from the Rest of Quebec. During the 2000 to 2004 period, there was a significant difference between Eeyou Istchee and the Rest of Quebec, particularly among males. In 2005-2009, as compared to 2000-2004, there was a decrease in the cancer-related mortality in males from the Rest of Quebec, but an increase in Eeyou Istchee males whose mortality rate therefore became comparable to that of males from the Rest of Quebec.

Table 3: All cancer mortality: age-adjusted rates (AAR) (per 100,000) and standardized rate ratios* (SRR) by Sex, 2000-2004 to 2005-2009

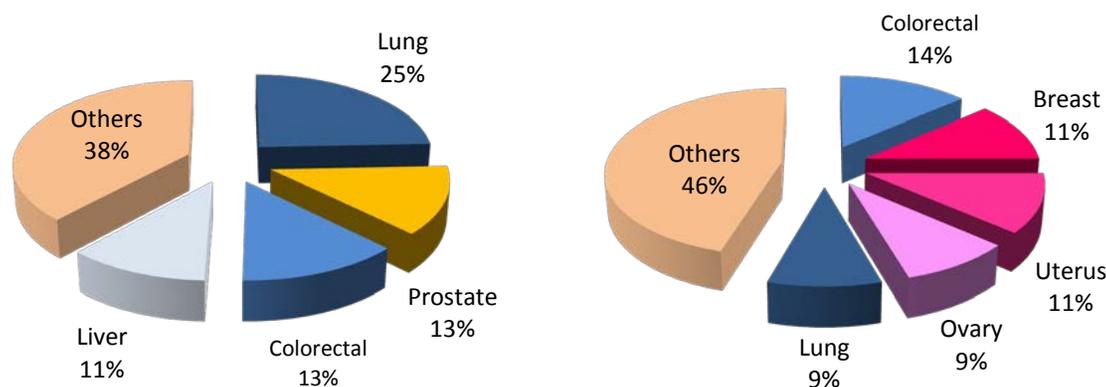
Health Region		Eeyou Istchee		Rest of Quebec		SRR (%)
		n**	AAR	n	AAR	
2000-2009	Females	44	157	83,373	186	85
	Males	56	214	93,159	267	80
	Total	100	186	176,532	219	<u>85</u>
2000-2004	Females	20	158	39,886	187	84
	Males	22	196	45,582	281	<u>70</u>
	Total	42	178	85,468	226	<u>79</u>
2005-2009	Females	24	156	43,487	184	85
	Males	34	229	47,577	254	90
	Total	58	191	91,064	213	90

* Standardized rate ratio (SRR) is obtained by dividing the (directly) standardized rate for Eeyou Istchee by that of the Rest of Quebec. Eeyou Istchee is said to have a lower incidence rate if the SRR is less than 100, or the opposite if the SRR is higher than 100. Significant differences at 95% CI are underlined.

** n = number of cancer related deaths

Regarding the main specific cancers that people are dying from in Eeyou Istchee, lung cancer in males is responsible for 1 out of every 4 cancer-related deaths, followed by colorectal and prostate cancers (1 out every 8 deaths for each). These three cancers are responsible for 50% of all cancer-related deaths in males. This is closely followed by cancer of the liver (11%). Among females, colorectal cancers (14%), breast cancer (11%) and cancer of the uterus (11%) are the top 3 causes of cancer mortality, followed by lung and ovarian cancer, each responsible for 9% of deaths. All together, cancer of female genital organs (ICD-10 code: C51-C58) is responsible for 23% of cancer-related deaths in women (Fig. 6a and 6b).

Figure 6a: Cancer deaths in males, Eeyou Istchee, 2000-2009 (Total n = 56) **Figure 6b: Cancer deaths in females, Eeyou Istchee, 2000-2009 (Total n = 44)**



2.1.4 All cancer survival in Eeyou Istchee

Table 4 reports the cancer mortality to incidence ratios (MIR). The complement of the cancer mortality-to-incidence ratio $[1-(M/I)]$ has been suggested as a valid proxy for the 5-year relative cancer survival rate (Vostakolaei et al., 2011; Tarabeia et al., 2007). The 5-year survival rate is interpreted as the proportion of new cancer patients who are still alive 5 years after their diagnosis. Compared to the Rest of Quebec, Eeyou Istchee had a slightly higher 5-year relative survival during the 2000 to 2004 period. However, this completely changed during the 2005 to 2009 period where the 5-year survival rate declined, from 55 to 45%. At the same time, the survival rate increased in the Rest of Quebec. As Table 4 shows, this decline in the rate of relative survival is due to decreased cancer survival in males, from 54 to 36%.

Table 4: Cancer Mortality-to-Incidence Ratio by Health Region

<i>Health Region</i>		Eeyou Istchee				Rest of Quebec			
		Inc. I	Mort. M	MIR M/I	Survival 1-(M/I)	Inc. I	Mort. M	MIR M/I	Survival 1-(M/I)
2000-2004	<i>Females</i>	360	158	0.44	0.56	422	187	0.44	0.56
	<i>Males</i>	425	196	0.46	0.54	546	281	0.51	0.49
	<i>Both sexes</i>	395	178	0.45	0.55	470	226	0.48	0.52
2005-2009	<i>Females</i>	349	156	0.45	0.55	428	184	0.43	0.57
	<i>Males</i>	355	229	0.64	0.36	536	254	0.47	0.53
	<i>Both sexes</i>	350	191	0.55	0.45	471	213	0.45	0.55

Inc.: Age-Adjusted Incidence Rate (per 100,000)

Mort.: Age-Adjusted Mortality Rate (per 100,000)

MIR: Mortality-to-Incidence Ratio

2.2 Specific cancer-site incidence

Since Eeyou Istchee's population size is small, the number of new cases of cancer is generally low. This prevents any detailed analysis by cancer type. Accordingly, we computed only SIR, to test if the number of specific cancer cases observed in the region is higher than what would be expected if the region were to experience the same age-specific cancer risk as the Rest of Quebec.

While the incidence for female breast cancer, as well as for other female cancers, is low (less than 2 cases per year on average) compared to what might be expected, these differences were not statistically significant. For prostate cancer and for the combined male cancers, the incidence varied, but whether the risk was higher or lower was not statistically significant. In regards to lung cancer, while the cumulative incidence decreased numerically, this was not statistically significant in comparison to the Rest of Quebec. Similarly with colorectal cancer, cases increased in comparison to the Rest of Quebec but were still not significantly different. However, for kidney cancer in Eeyou Istchee, the observed

incidence is two to five times higher than what would be expected in comparison to the Rest of Quebec, and this feature has been constant throughout the study period (Table 5).

Table 5: Standardized Incidence Ratio (SIR)* for specific cancer sites, 1985-1989 to 2000-2004

		Breast		Prostate		Lung		Colorectal		Kidney		Female cancers		Male cancers	
		<i>n</i>	<i>SIR</i>	<i>n</i>	<i>SIR</i>	<i>n</i>	<i>SIR</i>	<i>n</i>	<i>SIR</i>	<i>n</i>	<i>SIR</i>	<i>n</i>	<i>SIR</i>	<i>n</i>	<i>SIR</i>
1985-1989	Total					14	1.1	7	0.7	<u>10</u>	<u>4.9</u>				
	Females	5	0.5			3	1.0	2	0.5	<u>3</u>	<u>4.0</u>	10	0.7		
	Males			8	1.7	11	1.0	5	0.8	<u>7</u>	<u>5.0</u>			9	1.7
1990-1994	Total					6	0.3	10	0.7	<u>6</u>	<u>2.2</u>				
	Females	9	0.7			2	0.4	5	0.8	3	3.0	16	0.8		
	Males			6	0.7	4	0.3	5	0.7	3	1.7			7	0.7
1995-1999	Total					13	0.7	14	1.1	<u>12</u>	<u>4.2</u>				
	Females	9	0.6			6	1.0	10	1.8	<u>9</u>	<u>9.0</u>	16	0.7		
	Males			9	1.2	7	0.5	4	0.5	3	1.5			11	1.2
2000-2004	Total					13	0.7	17	1.0	<u>15</u>	<u>3.9</u>				
	Females	9	0.5			4	0.5	5	0.7	<u>8</u>	<u>5.9</u>	16	0.6		
	Males			6	0.5	9	0.9	12	1.2	<u>7</u>	<u>2.8</u>			8	0.6

* SIR is computed using Quebec as the reference population. A SIR of 4 means that the observed number of cases in Eeyou Istchee is 4 times higher than expected. Significant differences are underlined

2.3 Cancer at the community level in Eeyou Istchee

This report does not report data by community because of the risk of inaccurate reporting due to the small number of cases. Rather, we computed the SIR to test if the number of cancer cases observed in any community over the time period (1985-2006) is higher than what would have been expected had the community experienced the same age-specific cancer incidence rates as the whole of Eeyou Istchee. Few significant deviations were reported. Nemaska and Waskaganish had the lowest ratios and Ouje-Bougoumou and Whapmagoostui had the highest. However, the reported difference is statistically significant only for Waskaganish and Whapmagoostui (Table 6). Other lower or higher ratios could simply be explained by chance.

Table 6: Standardized Incidence Ratio by community: 1985-2006*

	No. of cases	SIR	p-value [§]
Mistissini	94	1.11	
Waswanipi	45	1.09	
Nemaska	10	0.62	
Oujé-Bougoumou	15	1.31	
Inland	164	1.07	
Chisasibi	97	0.91	
Eastmain	22	0.99	
Waskaganish	32	0.64	0.01
Wemindji	40	1.04	
Whapmagoostui	39	1.63	0.00
Coastal	230	0.95	
Unknown community	1		

*: Expected number of cancer cases were estimated by multiplying the Eeyou Istchee specific rates by each community's population data

§: p-value is indicated only when the difference between the actual and expected numbers of cases is statistically significant

3- Conclusion

This report gives an overall picture of the cancer incidence and mortality in Eeyou Istchee. The main findings from the data are as follows:

- a- The numbers of cancers in Eeyou Istchee have been increasing over the last 20 years because the size of the population has been increasing; however, the rates of cancer have been stable or are decreasing.
- b- In comparison to the situation in other Quebec health regions, the rates of cancer in Eeyou Istchee are lower (i.e. fewer people in Eeyou Istchee get cancer than in the Rest of Quebec) except kidney cancer which is more common. This applied most often to males, as differences between females from Eeyou Istchee and from elsewhere were generally not significant
- c- Colorectal cancer is increasing and is also the same as the rate in Quebec.
- d- The ratio of mortality to incidence increased in males, from 2000-2004 to 2005-2009, indicating a decrease of the 5-year cancer relative survival rate in males from Eeyou Istchee.
- e- Cree communities tend to have comparable incidence of cancer. Waskaganish, with a significantly lower and Whapmagoostui with a significantly higher than expected incidence, were the two communities that significantly differed from the rest of the region.

Some key lessons could also be derived from these findings:

- a- Main cancer risk factors, including risks for colorectal and kidney cancer, are related to lifestyle and include physical inactivity, obesity, smoking, heavy alcohol use, and type II diabetes, all factors that are highly and too often more prevalent in Eeyou Istchee as compared to the rest of Quebec.
- b- Public health programs and interventions that are not limited to individually-based or clinical strategies, but also include community-level strategies should be considered.
- c- As the prognosis for some cancers, such as colorectal, is poor, public health authorities might assess the benefits of screening for cancer as a preventive clinical practice.
- d- Follow-up analyses of patients with cancer could clarify why cancer survival in the region is decreasing in males.
- e- Overall, a strategy for closer surveillance and monitoring of cancer cases could help to identify the main risk factors and how services are meeting, or not, the needs of patients.

In brief, an aggressive promotion of healthy lifestyles, coupled with monitoring activities, is needed to prevent cancer and to reduce its burden in Eeyou Istchee.

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Appendices

Appendix 1: Data Sources and Definitions

Incidence Data: Observed cancer incidence data (1985-2006) were extracted from the *Fichier des Tumeurs du Québec* (FiTQ) for Health Region 18. The FiTQ is tumor-oriented, so if an individual had more than one primary tumor, each primary tumor is reported and counted. Data for the period 2007-2009 were estimated using the most recently available 5-year incidence rate, which was from 2002 to 2006. However, there was no estimation for the specific cancer site, due to the small number of incident cases per cancer type.

This analysis included primary malignant neoplasms (ICD-9 = 140-195 and 199 with a behavior code of 3), except non-melanoma skin cancer (ICD-9 = 173). It also included primary malignant neoplasm of lymphatic and hematopoietic tissue (ICD-9 = 200-208). Secondary malignant neoplasms (ICD-9 = 196-199 with a behavior code of 6), benign neoplasms (ICD-9 = 210 -229), carcinoma in situ (ICD-9 = 230-234) as well as neoplasms with uncertain behavior or unspecified nature (ICD-9 = 235-239) were excluded from analyses.

In addition, in this report, when analyzing kidney cancer, we refer to primary invasive tumors of all types that occur in the renal parenchyma of individuals 15 years of age or older. We therefore exclude the inner cavity of the kidney (renal pelvis) and nephroblastoma (Wilms' tumor) cases. Wilms' tumor is the predominant type of renal cancer that develops in children younger than 15 years of age (CCSSC, 2010). For female cancers, these refer to female breast and gynecological cancers (ICD-9 = 174, 179-184). Male cancers refer to prostate, testis and penile cancers (ICD-9 = 185-187).

Mortality Data: Quebec Vital Statistics (Registre des événements démographiques) is the data source for the cancer mortality reported in this publication. The main issue related to the mortality data is that they were coded with ICD-9 before 2000 and with ICD-10 from 2000 on. For malignant neoplasms (C00-C97), comparative analyses showed that the net impact of the introduction of the ICD-10 is a 1.2% increase in deaths attributed to cancer. This net impact is the sum of the movements into and out of the malignant neoplasms chapter, and does not necessarily reflect the net impact for a specific site of malignant neoplasms. For example, the introduction of the ICD-10 classification system generated no statistically-significant change in the number of deaths classified to the malignant neoplasm of the colon, rectum and anus. But it generated a 3.2% increase in the number of deaths classified to prostate cancer (cf. Table below). This report focused on cancer-related deaths during the 2000-2009 period.

Table i: Impact of the introduction of the ICD-10 for selected causes of death

Causes of death	ICD-10 codes	Comparability ratio	Percentage increase/decrease
<i>Malignant neoplasms</i>	<i>C00-C97</i>	<i>1.0124</i>	<i>1.2%</i>
Malignant neoplasm of colon, rectum and anus	C18-C21	0.9955	-0.4%
Malignant neoplasm of trachea, bronchus and lung	C33-C34	0,9810	-1.9%
Malignant neoplasm of breast	C50	1.0134	1.3%
Malignant neoplasm of prostate	C61	1.0319	3.2%

Source: Geran et al., 2005

Territorial Information: Sometimes, there are errors in municipality codes. For the purpose of this report, we identified and excluded 2 cases with contradictory residential information. The first one was reported and confirmed in 1994 while the second, reported in 1994, had no confirmation date. The first belonged to the municipality of Mistassini (Municipality code: 92020). Since Mistissini was named Mistassini (but with Municipality code: 99030) up to 1995, and was in the same administrative region (Saguenay-Lac-Saint-Jean) as the municipality of Mistassini, it was easy to interchange the two places. The second case belonged to the municipality of Winneway (Municipality code: 85804) in the administrative region of Abitibi-Temiscamingue. We kept a third case for which there was no residential information entered in 1995 when the case was reported and confirmed. It was only in 2007 that the system administrators attributed the CLSC code 18101 and therefore the Region code 18 to it.

Standard Population

The 2001 Quebec population used as the standard for calculating age-adjusted rates is shown below:

Age	Population
Under 10	842,250
10-19	930,568
20-29	989,042
30-39	1,126,476
40-49	1,243,873
50-59	966,780
60-69	624,916
70 et +	672,426

Source: MSSS, 2010. *Estimations de population selon le territoire de RSS, le sexe et l'année d'âge, au 1^{er} juillet, 1981 à 2005.* Ministère de la Santé et des Services sociaux, Service du développement de l'information

Study Population statistics

Population data for Eeyou Istchee and the Rest of Quebec were extracted from ISQ population estimates and projections published by the Ministère de la Santé et des Services sociaux of Quebec (MSSS, 2010). These data are based on Canadian population censuses and covered Aboriginal as well as non-Aboriginal people residing in Eeyou Istchee. Unfortunately, these data were not separated by community. Therefore, for community level analyses, population data used were from the Cree beneficiary list. This list does not take into account the non-Cree population. This choice could affect results if non-Cree had a higher cancer incidence as compared to Cree in some communities, and lower incidence in other communities. But even if this had happened, the impact was probably low since only 3.4% of the population is non-Aboriginal, and this proportion varies from 1.7% in Waswanipi to 6.6% in Uujé-Bougoumou. The second highest proportion was 4.5% and belongs to Chisasibi (Statistics Canada, 2006 Population Census).

Crude Incidence Rate: This is the number of new cancer patients which occur in a given time period divided by the population at risk during the same time period and multiplied by 100,000.

Standardization: Standardization (or adjustment) of rates is used to enable the valid comparison of groups (e.g., those studied in different places or times) that differ regarding an important health determinant (most commonly age). There are two methods of standardization: the direct one that yields the age-adjusted rate, and the indirect method to compute the standardized incidence ratio.

Age-Adjusted Rate (AAR): Age-specific rates are applied to a standard population in order to calculate what rate would be expected if a Health Region (e.g. Eeyou Istchee) had the same age distribution as the standard. The total of these expected events divided by the total of the standard population and multiplied by 100,000 yields the age-adjusted rate per 100,000. In this report, the 2001 Quebec population was used as the standard to compute each age-adjusted rate to allow proper comparability.

Standardized Rate Ratio (SRR): Rates that have been standardized by the direct method, using the same standard population (e.g. Quebec 2001), may be compared in relative or absolute terms (i.e., as a ratio or as a difference). For example, we can obtain a Standardized Rate Ratio (SRR) by dividing the (directly) standardized rate for Eeyou Istchee by that of any other health region, or of the Rest of Quebec, or the rates calculated for two different time periods.

Standardized Incidence Ratio (SIR): A SIR is used to determine if the occurrence of cancer in a relatively small population is higher or lower than expected, given the population and age distribution for that community. The SIR is obtained by dividing the observed number of cases of cancer by the expected number of cases. The expected number is the number of cases that would occur in a community if the disease rate in a larger reference population occurred in that community. Since cancer rates increase strongly with age, the SIR takes into account whether a community's population is older or younger than the reference one.

The expected number is calculated by multiplying each age-specific cancer incidence rate of the reference population by each age-specific population of the community in question and then adding up the results. If the observed number of cancer cases equals the expected number, the SIR is 1 or 100 if it

was previously multiplied by 100. If more cases are observed than expected, the SIR is greater than 1. If fewer cases are observed than expected, the SIR is less than 1.

Caution should be exercised, however, when interpreting an SIR. Indeed two SIRs can have the same size but not the same stability. In addition, the computed SIR for Eeyou Istchee should not be compared to the one computed for another Health Region, even if the two are calculated using the same 2001 Quebec population as reference population.

To determine if the observed number of cases is significantly different from the expected number, or if the difference may be due solely to chance, p-values were estimated. Specifically, a p-value $\leq .05$ is an indication that the difference is significant at a 95% Confidence Interval.

Reliability

Numbers of cancer cases were small. Data were therefore grouped by 5-year period. Crude rates (e.g., percentages and age-specific rates) based on less than 10 events were not displayed.

Caution in using crude or standardized rates: Standardized rates must not be used to estimate demand for services. Doing so is an incorrect practice. Indeed, the standardized rate reflects the number of new cases that would arise in a **hypothetical** population. The actual number of cases expected is given by the crude rate, which should always be employed in health care planning analyses. In contrast, while crude rates are useful for describing the disease burden in a particular population, they should not be used for comparing rates between different populations. One should also be aware that standardized rates are summary measures and therefore can hide age-specific differences in risk across time and place.

Appendix 2: Tables

Table A1: Eeyou Istchee's population by sex, age-group, and 5-year period

		1985-1989	1990-1994	1995-1999	2000-2004	2005-2009
Females						
	0-9	5,799	6,291	7,057	7,460	8,003
	10-19	5,495	5,875	5,656	6,210	6,806
	20-29	4,285	5,177	5,787	6,129	6,084
	30-39	2,552	3,389	4,195	5,037	5,679
	40-49	1,708	2,414	2,509	3,316	4,086
	50-59	1,154	1,368	1,827	2,178	2,624
	60-69	726	773	869	1,237	1,658
	70+	542	1,020	788	844	1,054
	Total	22,261	26,307	28,688	32,411	35,994
Males						
	0-9	5,829	6,645	7,456	7,823	8,951
	10-19	5,780	6,041	5,676	6,381	7,262
	20-29	4,326	5,640	5,981	5,963	5,949
	30-39	2,791	3,617	4,466	5,410	5,985
	40-49	1,627	2,297	2,627	3,327	4,248
	50-59	1,170	1,160	1,583	2,110	2,532
	60-69	731	827	1,000	1,131	1,379
	70+	616	816	830	917	1,065
	Total	22,870	27,043	29,619	33,062	37,371
Both Sexes						
	0-9	11,628	12,936	14,513	15,283	16,954
	10-19	11,275	11,916	11,332	12,591	14,068
	20-29	8,611	10,817	11,768	12,092	12,033
	30-39	5,343	7,006	8,661	10,447	11,664
	40-49	3,335	4,711	5,136	6,643	8,334
	50-59	2,324	2,528	3,410	4,288	5,156
	60-69	1,457	1,600	1,869	2,368	3,037
	70+	1,158	1,836	1,618	1,761	2,119
	Total	45,131	53,350	58,307	65,473	73,365

Sources: MSSS, 2010a, 2010b.

Table A2: Population and cancer incidence, Eeyou Istchee, 1985-2006

Year	Population	Cancer cases
1985	8,058	9
1986	8,772	14
1987	9,100	20
1988	9,425	17
1989	9,776	12
1990	10,116	12
1991	10,570	12
1992	10,734	17
1993	10,883	10
1994	11,047	19
1995	11,272	20
1996	11,539	16
1997	11,716	18
1998	11,828	21
1999	11,952	20
2000	12,166	24
2001	12,874	25
2002	13,149	19
2003	13,471	19
2004	13,813	21
2005	14,117	20
2006	14,336	30

Table A3: Specific cancer sites related deaths by sex, Eeyou Istchee, 2000-2009

Malignant neoplasms of specific sites	Sex		Total
	Males	Females	
C11 : Malignant neoplasm of nasopharynx	0	1	1
C15 : Malignant neoplasm of oesophagus	3	0	3
C16 : Malignant neoplasm of stomach	3	1	4
C18 : Malignant neoplasm of colon	4	5	9
C19 : Malignant neoplasm of rectosigmoid junction	1	0	1
C20 : Malignant neoplasm of rectum	2	1	3
C22 : Malignant neoplasm of liver and intrahepatic bile ducts	6	1	7
C24 : Malignant neoplasm of other unspecified parts of biliary tract	0	1	1
C25 : Malignant neoplasm of pancreas	2	3	5
C26 : Malignant neoplasm of other ill-defined digestive organs	1	1	2
C34 : Malignant neoplasm of bronchus and lung	14	4	18
C43 : Malignant neoplasm of skin	1	0	1
C49 : Malignant neoplasm of other connective and soft tissue	0	1	1
C50 : Malignant neoplasm of female breast	0	5	5
C51 : Malignant neoplasm of vulva	0	1	1
C53 : Malignant neoplasm of cervix uteri	0	3	3
C55 : Malignant neoplasm of uterus, part unspecified	0	2	2
C56 : Malignant neoplasm of ovary	0	4	4
C61 : Malignant neoplasm of prostate	7	0	7
C62 : Malignant neoplasm of testis	1	0	1
C64 : Malignant neoplasm of kidney, except renal pelvis	1	3	4
C71 : Malignant neoplasm of brain	1	1	2
C80 : Malignant neoplasm of without specification of site	2	2	4
C84 : Peripheral and cutaneous T-cell lymphomas	1	0	1
C85 : Other unspecified types of non-Hodgkin's lymphoma	2	1	3
C90 : Multiple myeloma and malignant plasma cell neoplasm	2	0	2
C91 : Lymphoid leukaemia	1	1	2
C92 : Myeloid leukaemia	1	0	1
C97 : Malignant neoplasm of independent (primary) multiple sites	0	2	2
Total	56	44	100